

## A REVIEW OF THE MEGATHYMIDÆ OF MEXICO, WITH A SYNOPSIS OF THE CLASSIFICATION OF THE FAMILY\*

by DON B. STALLINGS and J. R. TURNER

While most of our work with the Megathymidæ has been in the United States, we have spent considerable time in Mexico studying this family. In Mexico, as in the United States, most of our specimens have been collected in the larval or pupal stage.

Due to the fact that there is confusion as to the identity of the various species of *Yucca*, *Agave* and *Manfreda* plants upon which Megathymidæ feed, we have tried to photograph all food plants in both color and in black-and-white so that eventually the correct name for each food plant can be determined. Actually the problem confronting the botanist with these plants is as complex as our problem with Megathymidæ feeding on them. There is a definite relationship between the species of plants and the species of Megathymidæ, *i.e.*, a particular species of Megathymidæ will have a preference for one particular species of plant. The final solution may well be a joining of forces by the botanist and entomologist.

The family Megathymidæ is actually much larger than most lepidopterists realize. However, it does not presently appear to be as large as we once thought it would be. Our studies in Mexico now indicate that in southern Mexico and no doubt on into Central America the family is represented by only a few species having a very wide range. In northern Mexico and in the United States we find extreme specialization of the family, with a large number of species, each restricted to a small area. Thus far our studies in the United States indicate that only *Megathymus yuccæ* and *M. texana* have subspecies. Some subspeciation in Mexico will be discussed in this paper and more in a later paper.

In a general way we have explored throughout the Mexican mainland for Megathymidæ and now have a fairly good picture of the situation; however, there are large areas that we have not touched due to lack of roads and generally rough terrain. We expect it to be fully a hundred years before all the species of this family are discovered and described in Mexico. We describe five new species in this paper and at this time know of at least five more species, of which we have not yet been able to secure specimens in the adult stage. We also have several other new species and subspecies from Mexico that will be described in further papers after further research has been made. In the gulf of Lower California are a number of islands, a good many of which have endemic species of *Agave*. We will not be surprised to see these islands produce new species of Megathymidæ.

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\*This paper, our first synthesis of the knowledge of the Megathymidæ, is dedicated to the memory of Dr. R. C. TURNER, whose passing on 5 March 1958 came while this paper was in the printer's hands, 10 days before his seventy-first birthday. A "Meg" collector of unequalled enthusiasm, he is responsible for many of our finest discoveries. At the time of his passing he was preparing to join a new expedition, to the Hueco Mts. of Texas. He was the father of one of us and the father-in-law of the other.

In this paper we will discuss nearly all of the data that we now have on Mexican species. There is one particular area in Mexico that has presented so many interesting problems that we will not discuss material from that area until we have given it more study. That area has about seven or eight species and subspecies, most of which appear to be new.

Most major highways in Mexico have a roadside marker every one or five kilometers giving the number of kilometers from that spot to Mexico City. We give these marker numbers for locations where we collected.

### *Ægiale hesperiaris* Walker

This species feeds in various species of the giant *Agave* (Maguey). N. D. RILEY of the British Museum has kindly furnished us with colored slides of both surfaces of the type. Specimens from Mexico, D.F., appear to be typical and we have little doubt but that the type was collected in that vicinity. We therefore designate Mexico, D.F., Mexico, as the type locality of *Ægiale hesperiaris*. We will discuss *Ægiale kollari* Felder and *Ægiale agavis* Blasquez in a later paper.

There are some stages of the life history that we are not certain of as yet. We do know that the egg is glued to the leaf by the female and that the larva makes a cavity in the base of the leaf like our trap-door builders in the southwestern United States. They do not powder any portion of the larval cavity (or burrow). The larval cavity at its upper end usually turns at a right angle to make an opening to the outside on the underside of the leaf. At this opening it builds a semi-transparent trap-door, and often a second trap-door of similar material at the point where the burrow turns at a right angle. The upper portion of the burrow is coated with a thin layer of the same material as is used in the trap-doors. There are no strands of silk between the pupa and trap-door, unlike our United States trap-door builders. At the base of the burrow there is a thin webbing of this transparent material, below the pupa. The cremaster of the pupa is elongated with a knob on the end, covered with bristles and hooks. When the pupa rotates, these cremaster hooks catch in the webbing at the base of the burrow and anchor the pupa so that the adult can easily hatch and crawl out of the pupa case. This is one of the two known species having cremaster hooks. The larvæ are a silvery white color. We saw no evidence in August that frass was deposited outside the trap-door.

BLASQUEZ, (*La Naturaleza* 1: 282; 1870) reports that the eggs are deposited in October and November on the leaves and do not hatch until February and March. He further reports that "the eggs are always dispersed and never in groups". BARNES and McDUNNOUGH, (*Contrib. Nat. Hist. Lepid.* Vol. 1, no.3: p.18; 1912) quote BLASQUEZ as reporting that the larvæ pupate "in the upper part of the burrow in a silken cocoon". In our translation of his paper we find no reference to a "silken cocoon".

### *Megathymus maculosus* Freeman

35 miles southwest of China, Nuevo Leon, Mexico, we found a small colony of the food plant, *Manfreda maculosa*, of this species and secured a representative series of both the spring and fall broods. Specimens appear to be typical. While this species is a tent builder it is well to note that the larvæ do not build a tent until shortly before they pupate. Prior to that the covering over the hole is often more like a trap-door. Larvæ collected in December that normally would hatch in April can be slowed down to hatch in August and September, with the second brood, by keeping them in cool temperatures.

### *Megathymus smithi* Druce

July 10, 1956, KENT WILSON collected 6 specimens on the wing near Mazapa, Guerrero, Mexico, at an elevation of 3090 ft., which we identify as *M. smithi*. DRUCE described this species from a single male collected in September, 1888, at Amula, Guerrero,

Mexico. The type, a worn specimen, reveals a row of small light spots in the discal area on the upper secondaries. None of the specimens collected by WILSON show these spots, though both his specimens and the type show a narrow discal band of lighter coloring on the under surface of the secondaries. It is probable that the type of *Megathymus smithi* varies from the normal as do some specimens of *Megathymus rethon*. WILSON's specimens were collected in the same general area as was the type. We have discovered several colonies of Megathymidæ belonging to this species group (they may be *M. smithi*) in Mexico, and some specimens do have the spots in the discal area on the upper secondaries like the type of *Megathymus smithi*. We will discuss this material in another paper after we have given them further study.

The female of *Megathymus smithi* differs from the male by somewhat larger size, with the wings more rounded. Female spots are slightly larger than in the male and on the upperside of the primaries the spots in the female are yellow brown, while those spots in the male are whitish. We dissected the genitalia of both sexes of specimens caught by WILSON. The male genitalia appear to be the same as those in the drawing of the type furnished us by the late Brig. EVANS.

### *Megathymus mariæ* Barnes & McDunnough

Thus far we have collected several groups of specimens in Mexico that belong to the Mariæ complex; some are distinct species, and some seem to be subspecies. We will discuss these in a later paper when we have had time to give them further study. Typical *Megathymus mariæ* should occur in Mexico immediately south of the Big Bend country of Texas.

It is probably well to mention here that our trap-door builders in the United States appear to break into several groups. *Megathymus mariæ* and *M. stephensi* form one group. During August when we usually collect larvæ we have noted that *Megathymus mariæ* has considerable frass around the larval opening into the leaf. We have been advised that this is true of *Megathymus stephensi*, which we have not collected. None of the other trap-door builders in the United States have visible frass during this period, although in spring and early summer all do have the frass in sight. These last mentioned trap-door builders complete their feeding in the larval stage during the last of June and first of July and then become dormant. They do not pupate or build their trap-door until 10 to 20 days prior to emerging as adults in September and October.

We are not yet certain as to how all of the trap-door builders deposit their eggs. FREEMAN reports that he saw a female of his *Megathymus evansi* flipping the eggs into the base of the plant. We have not been in the field at the proper time to observe this. All eggs that we have seen laid by the Megathymidæ have been glued to a leaf. All eggs that we have seen form a hemisphere, the flat side being attached to the leaf. We suspect that the eggs of those that flip would be round.

Each species group of the trap-door builders appears to have a different color for its trap-door. Some species can be identified by the color of the trap-door. There also seems to be a difference in the texture of the trap-doors; this may well prove to be specific.

Throughout this paper, when we refer to frass not being outside the trap door or opening, we mean it was not there during August when we examined the colony.

### *Megathymus comstocki* Harbison

The excellent description of this newly described species from Baja California, Mexico, appears in the *Trans. San Diego Soc. Nat. Hist.*, vol.12: no.12, 1957, and in the succeeding number of this publication Dr. JOHN A. COMSTOCK gives a well rounded discussion of the life history. We have recently examined specimens of this species and are unable to associate this species with *Megathymus polingi* Skinner, which appears to be in a group by itself. The cremaster of the pupa of *Megathymus comstocki* is much more like the triangular cremaster of *M. mariæ* and not at all like the blunt, almost rounded cremaster of *M. polingi*. The wings in shape and pattern show a closer relation to *M. mariæ*. We associate *M. comstocki* with *M. mariæ* and two new species herein described.

*Megathymus rethon* Dyar

This species was described by DYAR from a single male specimen collected in "Sierra de Guerrero, Mexico" in August, 1911. Near Cuautla, Puebla, Mexico, at an elevation of 3800 feet we collected a number of larvæ and pupæ of *M. rethon*. These emerged during the last of August and throughout Sept. In this area there appeared to be two species of *Agave* growing together. One appeared to be *Agave sisalana* Perrine which is often cultivated for its fiber. The other species (if it was another) was slightly smaller in size with the leaves green whereas the first mentioned plants had gray-green leaves. The larger plants were much more common than the smaller. All larvæ were found in the small plants with green leaves. These *Agave* grew in a rather dense growth of small (under 3 ft.) palm plants. The trap-doors were white and were on the underside of the leaf. The larvæ were a dark red-brown. There was no evidence of frass outside the trap-door, although we suspect that frass was there but had been washed away by recent rains.

While this species on the upper surfaces appears to be a solid black with a white fringe, a few specimens plainly show that the forewing has a series of spots similar to *Megathymus mariae*. It is just that in most instances these spots are completely covered with black. These spots are revealed on the underside more often than on the upper. A number of individuals have a discal row of white spots on the lower secondaries. The female looks just like the male except that it is slightly larger, with the wings slightly more rounded.

There was a large number of black skippers with white fringes flying in this vicinity, which suggests that *M. rethon* may be mimicking one of them. Superficially it looks totally different from other Megathymidæ. We collected other specimens of *M. rethon* in Oaxaca just a few miles north of the northern line of Chiapas, and other specimens in Puebla.

*Megathymus indecisa* Butler & Druce

Thus far we have not collected this species. We did find a species along the Oaxaca — Chiapas line but were unable to secure adult specimens. This might be *M. indecisa*, but we don't think so, as the cremaster of the pupa case showed a close relationship to *M. rethon*, and at present we do not associate *M. indecisa* with the *M. rethon* complex.

*Megathymus aryxna* Dyar

The International Commission on Zoological Nomenclature has to our regret ruled that the lectotype of this species is the specimen represented by the picture that DYAR refers to in his original description and is not any of the ten specimens that he actually had before him when he described this species. (See the paper by SABROSKY, *Lepid. News* 11: 29-34; 1958.)

We have not as yet collected specimens of this species in Mexico. At the present time we apply this name to the common species of *Megathymus* found in southeast Arizona feeding on *Agave palmeri*, which in the past has been confused with *M. neumoegeni* and is presently being confused with *M. evansi* by some collectors.

At the present time we consider *Megathymus drucei* Skinner a synonym of *M. aryxna*. We do wish to mention here that we have previously (*Lepid. News*. 8: 78; 1954) pointed out that there was a species in Mexico that the name *Megathymus drucei* might apply to. We have now collected a good series of this species, and it is not *M. drucei*. FREEMAN will describe this species in a paper soon to be published.

*Megathymus hoffmanni* Freeman

We did some diligent hunting for this species but found only one pupa near Zoquiapan, D.F., Mexico, at an elevation of 8300 feet. The food plant looks very much like *Agave scabra* Lam-Dyck. This species is closely related to *Megathymus neumoegeni* and *M. chisosensis*. Both of these species place a number of silk strands across their



burrow below the trap-door and above where they pupate. This pupa of *M. hoffmanni* had a large number of such silk strands, but no trap door. It might have been blown away; further collecting will be necessary before this can be confirmed. Our specimen emerged Sept. 9, 1956. We have seen specimens that were caught as early as July, from this same general area. We collected this pupa Aug. 7, 1956, and found many empty burrows at that time. There was no frass below the burrow opening, and the opening was on the under side of the leaf.

### *Megathymus belli* Freeman

This species was described from a single male, badly worn, which was caught at La Bequilla, Durango, Mexico, July 29, 1902. We have examined the slide of the genitalia of the type. The uncus is damaged with parts missing; careful examination of the uncus discloses that it is in fact bifid, although the original description stated the reverse.

North of Chihuahua, Chihuahua, Mexico, at Klm. 1775 at an elevation of 5000 ft. we found an *Agave* that looks very similar to *A. parryi*. From these plants we collected a number of dull greenish-black larvæ. The trap-doors were on the under side of the leaf and were a shiny jet black. Seven males and two females emerged during September. We have dissected both sexes. The male valva is identical to FREEMAN'S drawing of the valva of the type. The uncus appears to be the same. The specimens are marked and colored like the type (we have examined the type and have a colored photograph of it). FREEMAN, in describing *M. belli*, states: "On the primaries *belli* lacks the elongated orange spot near the base of the wings which is found in *evansi* . . ." Actually this spot, much reduced, does appear on the type of *M. belli* and on our specimens.

### *Megathymus remingtoni* Stallings & Turner, new species

FEMALE: Upper surface of primaries: dull brown-black with the base over-scaled with brown hairs, extending outward towards the outer angle. Spots 1 (cell spot), 2, 3, 4 (subapical spots), 5, 6 (submarginal spots), 7, 8, and 9 (discal band) are yellow with a little brown tinge. Spot 9 is irregular, with the upper portion extending outward towards the fringe and the lower portion extending inward towards the base. The fringes are checkered brown-black and smoky white.

Under surface of primaries: dull black-brown with the apex and outer edge over-scaled with white, giving a gray appearance. All the spots of the upperside reappear, with spots 2, 3, 4, 5, and 6 lighter, spots 2 and 3 being almost white.

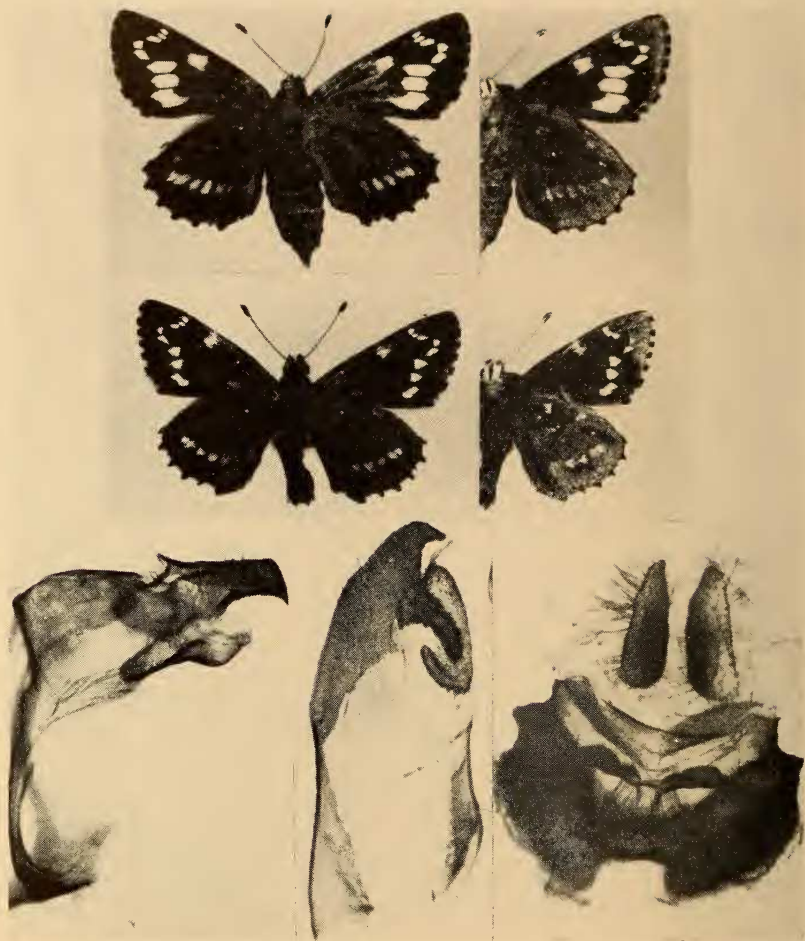
Upper surface of secondaries: dull brown-black with the base over-scaled with brown hairs. The discal band is composed of 5 yellow-brown spots, darker than the spots in the forewing, in a very straight line. The inner 3 spots of the discal band are well separated while the outer two have only a faint line between them. All 5 spots appear to point downward. The fringes are checkered brown-black and smoky white.

Under surface of secondaries: dull black-brown evenly over-scaled with white. The discal band reappears as white spots, with a sixth spot inward. There are two small white spots in the costal area and a very small white spot centered in the wing inward from the discal band.

Abdomen: dull brown-black above, brown-gray below. Thorax: dull brown above, gray-brown below. Palpi: dull white with a few black scales. Antennæ: base and tip of club are white; the remainder of the antenna is blackish, with white at the joints.

Length of forewing varies from 20 to 24 mm.; average 23.5 mm. Wing measurements of holotype: forewing, apex to base 24 mm.; apex to outer angle 15 mm., outer angle to base 18 mm.; hindwing, base to end of vein  $Cu_1$  18 mm.

MALE: Upper surface: dull black-brown with both wings over-scaled with brown hairs towards the base. All spots are smaller and lighter than in the female, with spots 7 and 8 of the primaries triangular in shape, the apex of the triangles pointing outward. Spot 9 is irregularly elongated, similar to that of the female. There is a small elongated orange-brown spot near the base of the primaries.



Top row: *M. remingtoni* HOLOTYPE ♀, Jacala, Mexico, 10 Sept. 1956 (S. & T. Collection).

2nd row: *M. remingtoni* ALLOTYPE ♂, Jacala, Mexico, 5 Sept. 1956 (S. & T. Collection).

[Uppersides at left; undersides at right]

Lower row: *M. remingtoni* genitalia, left to right: ♂ uncus and ♂ valva, Jacala, Mexico, 13 Sept. 1956 (No. 163, S. & T. Collection); ♀ genital plate, Jacala, Mexico, 7 Sept. 1956. (No. 162, S. & T. Collection).

Under surface: black, otherwise like the female, with spots reduced, except that the discal band of the secondaries does not normally have the sixth spot of the female.

Abdomen: dull black-brown with some gray below. Thorax: dull black-brown above, dull black below. Palpi and antennae like those of the female.

Length of forewing varies from 20 to 23 mm., average 22 mm. Wing measurements of Allotype: forewing, apex to base 22 mm., apex to outer angle 13 mm., outer angle to base 16 mm.; hindwing, base to end of vein  $Cu_1$  16 mm.

Described from 38 specimens (25 males and 13 females) reared from larvae collected in the mountains south of Jacala, Hidalgo, Mexico, on highway 85 at Klm. 250, elevation 6000 ft., emerging in confinement from August 26 to September 23, 1956 and 1957. Collected by Dr. & Mrs. R. C. TURNER, Dr. J. R. TURNER, DEE, JACK, VIOLA and DON B. STALLINGS.

HOLOTYPE, female, Sept. 10, 1956, and ALLOTYPE, male, Sept. 5, 1956, are in the collection of the authors. Paratypes of both sexes will be placed in the following collections: H. A. FREEMAN, C. L. REMINGTON, U.S. National Museum, American Museum of Natural History, TARSICIO ESCALANTE, and the Secretario de Agricultura y Ganaderia for placement in the proper scientific institute in Mexico.

The food plant is an *Agave* that looks somewhat like our *Agave utahensis*. The white larva places its trap door on either side of the leaf. The trap-door is dark brown and very thin, particularly at the center. Sometimes the center of the trap-door is not completed, leaving a tiny opening. The larva deposits its frass outside the trap-door, like the other species in the *Megathymus mariae* group. This species is closely related to *M. comstocki*, but the spots of *M. remingtoni* are darker. Spot number 9 on the upperside of the primaries of both sexes, particularly the female, is longer than the two spots immediately above it, while in *M. comstocki* spot 9 is shorter than the spots above. The color of the larva is different, and the genitalia show substantial differences. *Megathymus remingtoni* is distinguished from *M. mariae* by being slightly smaller in size. Its ground color is darker, particularly on the under surfaces, and all of its spots are much smaller than the corresponding spots of *M. mariae*.

It was interesting to note that on leaves of the food-plant where the leaf hung over a steep incline so that the tip of the leaf was lower than the base of the leaf the burrow then went up the leaf (but down according to gravity). Plainly the larva did not wish to rest upside down.

This species is named in honor of our good friend Dr. CHARLES L. REMINGTON.

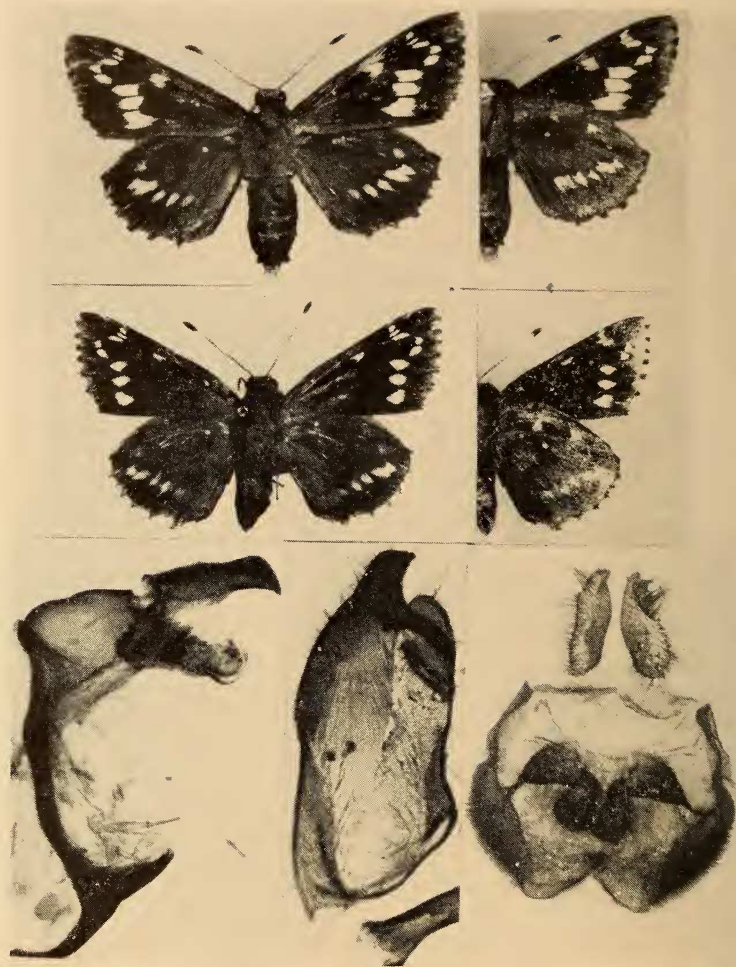
### *Megathymus estelleae* Stallings & Turner, new species

FEMALE: Upper surface of primaries: dull brown with the base overscaled with yellow-brown hairs. Spots 1 (cell spot), 2, 3, 4 (subapical spots), 5, 6 (submarginal spots) 7, 8, and 9 (discal band) are yellow with a brown tinge. Spot 9 is square outward, triangular inward. The fringes are checkered brown and smoky yellow.

Under surface of primaries: dull dark brown with the apex overscaled with white, giving a yellow-brown appearance. All the spots of the upperside reappear, with spots 2 and 3 lighter.

Upper surface of secondaries: dull brown (a little lighter than the primaries), with the base overscaled with yellow-brown hairs. The discal band is composed of 5 yellow spots with a brown tinge, all in a straight line. There is a distinct spot above the outer spot of the discal band. All 5 spots are distinctly pointed outward. The inner 3 spots of the discal band are well separated, while the outer two have only a faint line between them. All 5 spots appear to point outward. The fringes are checkered brown and smoky yellow.

Under surface of secondaries: dull dark brown. The discal band reappears as well defined white spots distinctly pointed outward, with a sixth spot inward joined with the fifth spot. The spot above the outer spot of the discal band is present, and two white spots are in the costal area. The wing is evenly overscaled with white except the area immediately around the spots, which makes the spots appear more distinct.



Top row: *M. estelleæ* HOLOTYPE ♀, General Bravo, Mexico, 24 Aug. 1956. (S. & T. Collection).

2nd row: *M. estelleæ* ALLOTYPE ♂, General Bravo, Mexico, 9 Sept. 1956. (S. & T. Collection).

[Uppersides at left; undersides at right]

Lower row: *M. estelleæ* genitalia, left to right: ♂ uncus and ♂ valva, General Bravo, Mexico, 2 Sept. 1956 (No. 161, S. & T. Collection); ♀ genital plate, HOLOTYPE (No. 182, S. & T. Collection).



Abdomen: dull brown above and below. Thorax: dull yellow-brown above, gray-brown below. Palpi: white. Antennæ: club brown, remainder of antennæ brown, with white at joints.

Length of forewing 25 mm. Wing measurements of holotype: forewing, apex to base, 25 mm., apex to outer angle 15 mm., outer angle to base 19 mm.; hindwing, base to end of vein  $Cu_1$  19 mm.

MALE: Upper surface: dull brown-black, with both wings overscaled with brown hairs towards the base. All spots smaller and lighter than in the female, with spots 7 and 8 of the forewing roundish. Spot 9 triangular with the apex pointed inward. There is a small indistinct yellow-brown spot near the base of the primaries. The fringes are checkered dark brown and smoky yellow.

Under surface: black-brown, otherwise like the female, with spots reduced, except that the discal band of the secondaries does not have the sixth spot of the female, and the white overscaling on the secondaries extends right up to the spots.

Abdomen: dull brown-black with some gray below. Thorax: brown-black above, grayish below. Palpi and antennæ like those of the female.

Length of forewing varies from 22 to 23 mm., average 22.5 mm. Wing measurements of Allotype: forewing, apex to base 23 mm., apex to outer angle 13 mm., outer angle to base 17.5 mm.; hindwing, base to end of vein  $Cu_1$  16.5 mm.

Described from 5 specimens (4 males and 1 female) reared from larvæ collected on the plains 56 miles southwest of Reynosa, Mexico, near General Bravo, Nuevo Leon, Mexico, at an elevation of 400 ft., emerging in captivity from August 24th to Sept. 9th, 1956. Collected by Dr. & Mrs. R. C. TURNER, Dr. J. R. TURNER, DEE, JACK, VIOLA and DON B. STALLINGS.

HOLOTYPE, female, August 24th, 1956, and ALLOTYPE, male, Sept. 2, 1956, are in the collection of the authors.

The food plant is an *Agave* that looks very much like *Agave lechuguilla*, however this plant a little farther south begins to develop a bright yellow stripe down the center of the leaf. The white larva places its trap-door on either side of the leaf. The trap-door is very thin and pale tan (almost white) in color. We are sure that this species deposits its frass outside the trap door; however, we did not find any. We believe this was due to the strong winds in the area. The larva in many instances burrows into the base of the plant as far as 2 inches. The burrow goes into the base of the plant much deeper than any of the other known species of this group, except possibly *Megathymus polingi*.

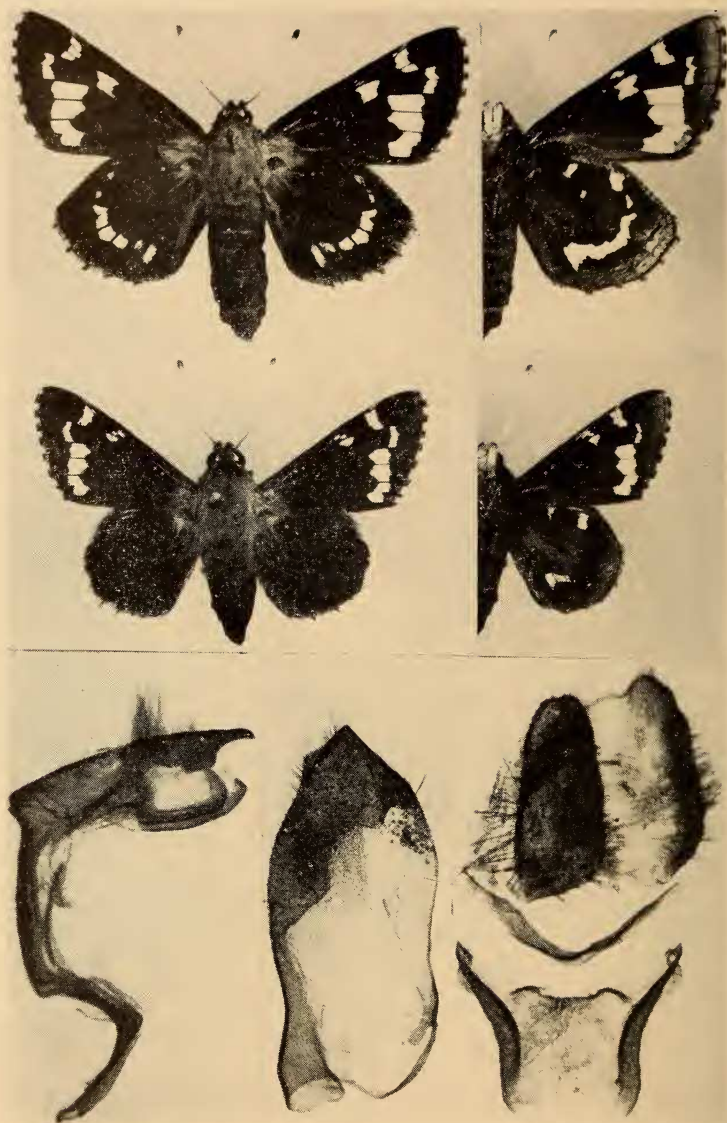
This species is closely related to the preceding species but is readily distinguished from it by the following differences: 1) the forewings of both sexes are narrower than in *M. remingtoni* and the outer edge is more straight; 2) *Megathymus estelleæ* is brownish with the light color of the fringe yellow as compared to the more blackish color of *M. remingtoni* and the whitish in the fringe; 3) the shape of spot 9 in the forewing of both sexes is quite different.

This species is named in honor of ESTELLE STALLINGS, the aunt of the first named author who took care of him when a small boy after the death of his mother and who assisted him during his college education.

### *Megathymus beulahæ* Stallings & Turner, new species

FEMALE: Upper surface of primaries: bright black with a few yellow-brown hairs at the base. Spot 1 (cell spot) is roughly square, with the upper part projected outward. Spots 2, 3, and 4 (subapical spots) are rectangular and of even size, spot 3 being set in towards the base more than spots 2 and 4. Spots 5 and 6 (submarginal spots) are not quite as wide as they are tall and are set just outside the outer edge of the discal band. Spots 7, 8, and 9 (discal band) are nearly in a straight line with each spot (downward) being smaller than the one above. The lower two spots (8 and 9) are toothed inward. All 9 spots are a bright chalky yellow in color. The fringes are checkered black and white.

Under surface of primaries: dull black with the apex and outer margin lightly overscaled with white. All the spots reappear but are much lighter, with spots 2, 3, and 4 being white.



Top row: *M. beulahæ* HOLOTYPE ♀, Ixmiquilpan, Mexico, 12 Aug. 1956 (S. & T. Collection).

2nd row: *M. beulahæ* ALLOTYPE ♂, Ixmiquilpan, Mexico, 11 Aug. 1956 (S. & T. Collection).

[Uppersides at left; undersides at right]

Lower row: *M. beulahæ* genitalia, left to right: ♂ uncus and ♂ valva, Ixmiquilpan, Mexico, 6 & 19 Aug. 1956 (Nos. 187 & 164, S. & T. Collection); ♀ genital plate, Ixmiquilpan, Mexico, 19 Aug. 1956 (No. 165, S. & T. Collection).

Upper surface of secondaries: bright black with a few yellow-brown hairs at the base. There is a very narrow (about the same width as the fringe) border of chalky yellow with a few black scales intermixed. The bright chalky yellow discal band is composed of a curved row of 8 spots; the two upper spots are rather small, and the lower spot (in the anal area) is elongated outward; the remaining spots are all about the same size. The fringes are white.

Under surface of secondaries: black, with the area inside the discal band overscaled with short light brown hairs and the area outside the discal band overscaled with white scales. The upper two spots of the discal band reappear on the under surface as well defined white spots. The remaining spots of the discal band reappear on the under surface as a broad white band. There is another white spot just below the costal area near the base and still another white spot below this one. The costal area is overscaled with white scales and short hairs.

Abdomen: black above and brown-black below. Thorax: yellow-brown above, brown-black below. Palpi: white with some gray intermixed. Antennæ: tip of club dull black, remainder of club and shaft white with some black overscaling towards the base on the upper side but all white below.

Length of forewing varies from 28 mm. to 32 mm., average 31 mm. Wing measurements of Holotype: forewing, apex to base 31 mm., apex to outer angle 31 mm., outer angle to base 23.5 mm.; hindwing, base to end of vein  $Cu_1$  21.5 mm.

MALE. Upper surface of primaries: black with a few yellow-brown hairs at the base. All 9 spots are reduced in size compared to the female and are slightly paler in color, with spots 2, 3, and 4 being white. Spots 7 and 8 are the same size and toothed inwardly. Spot 9 is indented outwardly and toothed inwardly. The fringes are checkered black and white.

Under surface of primaries: black-brown with the apex and outer margin very lightly overscaled with white. All the spots of the upperside reappear but are lighter, with spots 2, 3, and 4 white. The fringes on the underside are checkered black and light brown.

Upper surface of secondaries: black with a few yellow-brown hairs at the base. The chalky yellow border is slightly broader than in the female. The fringes are white.

Under surface of secondaries: black-brown, with the area inside the discal band overscaled with short light brown hairs and the area outside the discal band overscaled with white scales. The discal band is composed of a black band with a white spot just below the costal area and two joined white spots in the anal area. There is a triangular white spot near the base just below the costal area and a rectangular black spot below this white spot. The costal area is overscaled with short white hairs and scales. The fringes on underside are light brown.

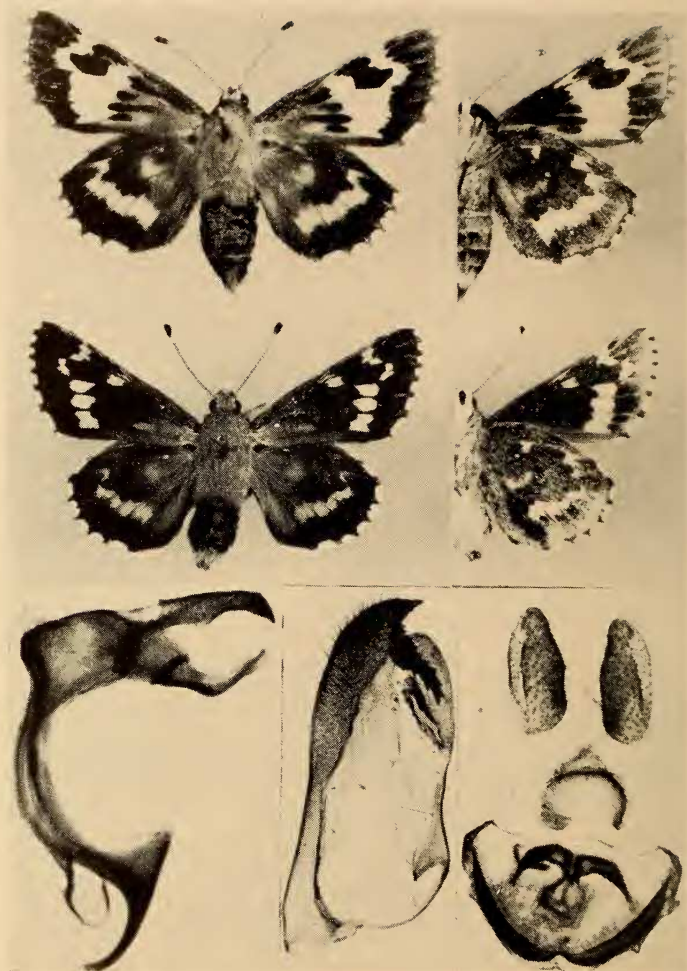
Abdomen, thorax, palpi, and antennæ as in the female.

Length of forewing varies from 23 to 26 mm., average 25 mm. Wing measurements of Allotype: forewing, apex to base 25 mm., apex to outer angle, 15 mm., outer angle to base 18 mm.; hindwing, base to end of vein  $Cu_1$  17 mm.

Described from 52 specimens (27 males and 25 females) collected near Ixmiquilpan, Hidalgo, Mexico, on highway 85 at Klm. 176 at an elevation of 5700 ft., emerging from pupæ August 6 to 31, 1956 and 1957. Collected by Dr. & Mrs. R. C. TURNER, Dr. J. R. TURNER, DEE, JACK, VIOLA and DON B. STALLINGS.

HOLOTYPE, female, August 12, 1956 and ALLOTYPE, male, August 11, 1956 are in the collection of the authors. Paratypes of both sexes will be placed in the following collections: H. A. FREEMAN, C. L. REMINGTON, KENT WILSON, TARSICIO ESCALANTE, U.S. National Museum, American Museum of Natural History, and Secretario de Agricultura y Ganaderio for placement in the proper scientific institute in Mexico.

This is a most unusual species in a number of ways. It is a true *Megathymus*. It builds the usual tent in the center of the food plant. The food plant is unusual — for it is an *Agave*. The plant looks very much like our *Agave schottii* in Arizona. The inflorescence is spicate and the flower is a dark maroon with green. The fact is, the plant looks more like a *Yucca* than an *Agave*. *Megathymus beulahæ* no doubt, thinks the plant is a *Yucca*.



Top row: *M. julia* HOLOTYPE ♀, Zarca, Mexico, 23 Sept. 1956 (S. & T. Collection).

2nd row: *M. julia* ALLOTYPE ♂, Zarca, Mexico, 27 Sept. 1956 (S. & T. Collection).

[Uppersides at left; undersides at right]

Lower row: *M. julia* genitalia, left to right: ♂ uncus and ♂ valva, Zarca, Mexico, 27 Sept. 1956 (No. 175, S. & T. Collection); ♀ genital plate, Zarca, Mexico, HOLOTYPE (No. 176, S. & T. Collection).



*Megathymus beulahæ*, in its markings on the upper surface, appears closest to the *Megathymus yuccæ* complex, but the under surface of the secondaries will certainly distinguish it from the *Megathymus yuccæ* complex and, in fact, from all other species. The white antennæ and the genitalia of both sexes indicate that it is in fact a member of the *Megathymus ursus* complex. Its flight period would also indicate this.

It is named in honor of the wife of the second-named author, BEULAH TURNER, who has taken part in a good share of our work on this group.

We have a subspecies of this species that we will describe at a later date.

### *Megathymus julia* Stallings & Turner, new species

**FEMALE:** Upper surface of primaries: orange-yellow with an irregular dull black border along the outer edge of the wing 4 to 7 mm. wide. The base is overscaled with orange hairs. Spots 1 (cell spot), 2, 3, 4 (subapical spots), 5, 6 (submarginal spots), 7, 8, and 9 (discal band) are all fused together with the deeper orange-yellow in the basal area. There is an irregular black spot between the cell and the subapical area. There is a long narrow triangular black spot in the costal area towards the base. Below this spot are 3 more black spots, the middle one being 5.5 mm. long and the other two 2 mm. long. The fringes are checkered dark gray and white.

Under surface of primaries: gray-black, with the apex overscaled with white. The spots of the upperside reappear but are yellow, except spots 2, 3, and 4, which are white. In the gray-black area the veins are edged with white.

Upper surface of secondaries: orange-yellow with a dull black border 4 mm. wide. The base is overscaled with orange hairs. There is a band of black, well overscaled with orange, inward from the discal area. The band narrows and weakens in color towards the anal area. The fringes are checkered dark gray and white.

Under surface of secondaries: Gray black heavily overscaled with white. The discal band is composed of distinct white spots 3 mm. wide. There are two more white spots in the costal area.

Abdomen and thorax brown above and gray below. Palpi: white with a few black scales. Antennæ black, ringed with white; the base of the club is white, the remainder black.

Wing measurements of Holotype: forewing, apex to base 28 mm., apex to outer angle 18 mm., outer angle to base 21 mm.; hindwing, base to end of vein  $Cu_1$  21 mm.

**MALE:** Upper surface of primaries: dull black with the base overscaled with orange hairs. Spots 1, 2, 3, 4, 5, 6, 7, 8, and 9 orange-yellow and not fused together. Spot 5 considerably longer than spot 6. Spots 7, 8, and 9 about equal in size (2.5 mm.). There is a small elongated orange spot inward from spot 9, near the base. The fringes are checkered dark gray and white.

Under surface of primaries: very dull black, with the apex overscaled with white. The spots reappear as above and are yellow, except spots 2, 3, and 4, which are white. Veins in the marginal area are edged with white.

Upper surface of secondaries: dull black, with the base overscaled with orange hairs. The discal band is orange, with the veins so lightly edged with black that the band appears unbroken. The fringes are checkered dark gray and white.

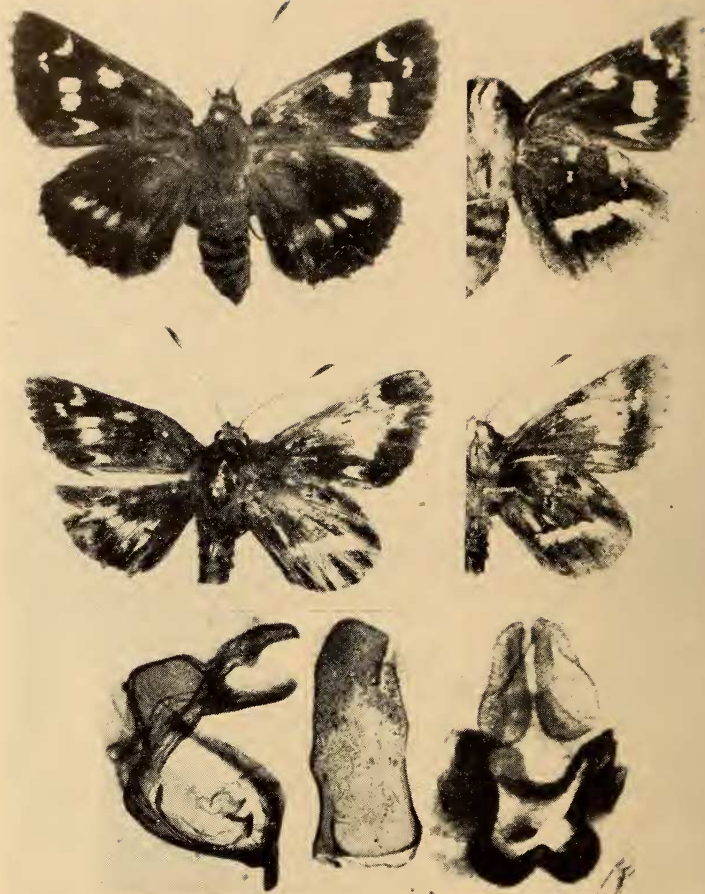
Under surface of secondaries: like the female.

Abdomen, thorax, palpi, and antennæ same as in the female.

Wing measurements of Allotype: forewing, apex to base 25.5 mm., apex to outer angle 16 mm., outer angle to base 19 mm.; hindwing, base to end of vein  $Cu_1$  18 mm.

Described from 3 specimens (2 males and 1 female) reared from larvæ collected north of Zarca, Durango, Mexico, on Highway 45 at Klm. 1317, elevation 6300 ft., emerging from Sept. 18 to 27, 1956. Collected by Dr. & Mrs. R. C. TURNER, Dr. J. R. TURNER, DEE, JACK, VIOLA and DON B. STALLINGS.

**HOLOTYPE**, female, Sept. 23, 1956, and **ALLOTYPE**, male, Sept. 27, 1956, are in the collection of the authors.



Top row: *M. hazelae* HOLOTYPE ♀, Chilpancingo, Mexico, 15 Sept. 1956 (S. & T. Collection).

2nd row: *M. hazelae* ALLOTYPE ♂, Chilpancingo, Mexico, 23 Sept. 1956 (S. & T. Collection).

[Uppersides at left; undersides at right]

Lower row: *M. hazelae* genitalia, left to right: ♂ uncus and ♂ valva, Chilpancingo, Mexico, ALLOTYPE (No. 158, S. & T. Collection); ♀ genital plate, Chilpancingo, Mexico, 22 Sept. 1956 (No. 157, S. & T. Collection).

The area where these specimens were collected is flat country. The food plant is a rather small *Agave* that looks a little like *Agave parryi*. The trap-doors were on the underside of the leaf and were brown. Parasites were numerous.

The female appears closest to *Megathymus chisosensis*. The male appears closest to *M. hoffmanni*. *Megathymus julia* is easily distinguished from both species by the distinct white discal band on the under side of the secondaries. Actually, the orange-yellow spots of this species have a slight brown cast, reminding us of the color of the spots of *M. baueri* Stallings & Turner and allied species.

Named in honor of Mrs. JULIA DICKSON, our aunt of Victoria, Mexico, who, though past 70, joined in our collecting expeditions throughout Mexico and acted as our interpreter.

### *Megathymus bazelæ* Stallings & Turner, new species

**FEMALE:** Upper surface of primaries: black-brown with a few yellow-brown hairs at the base. Spot 1 (cell spot) is squarish and slightly larger than spots 7 and 8. Spots 2, 3 and 4 are small, forming a crescent facing outward. Spots 5 and 6 are minute; sometimes spot 6 is missing. Spots 7 and 8 are square. Spot 9 is triangular, with the apex pointed inward, and the base of the triangle deeply indented. Spot 9 is set inward from spots 7 and 8. All spots are yellow with a slight brown cast. The fringes are checkered dark gray and smoky white.

Under surface of primaries: black-brown with the outer margin overscaled with white. The apex is faintly overscaled with yellow-brown. The spots reappear as above, with spots 2 and 3 white, spots 4 and 5 light yellow, and the remaining spots as above.

Upper surface of secondaries: black-brown with a few yellow-brown hairs at the base. The discal band is straight, composed of 5 spots, the same color as the spots on the primaries. The outer spots of the discal band are scaled while the inner spots have yellow brown hairs and do not appear as distinct as the outer spots. The fringes are checkered dark gray and smoky white.

Under surface of secondaries: black-brown overscaled with white outside the discal band. Overscaled with light brown scales inside the discal band. The white discal band is straight with the spots joined together. Both ends of the discal band fuse downward with the white overscaling. The outer costal area is overscaled a bit heavier with white, forming a white triangle. There is a very small white spot below this triangle. Below the costal area near the base is a white spot with a small white spot below it.

Abdomen and thorax are brown above, gray below. Palpi are sordid white. Antennæ are black-brown above, ringed with white below.

Length of forewing varies from 18 to 20 mm., averages 19 mm. Wing measurements of Holotype: forewing, apex to base 20 mm., apex to outer angle 14 mm., outer angle to base 14.5 mm.; hindwing, base to end of vein  $Cu_1$  14.5 mm.

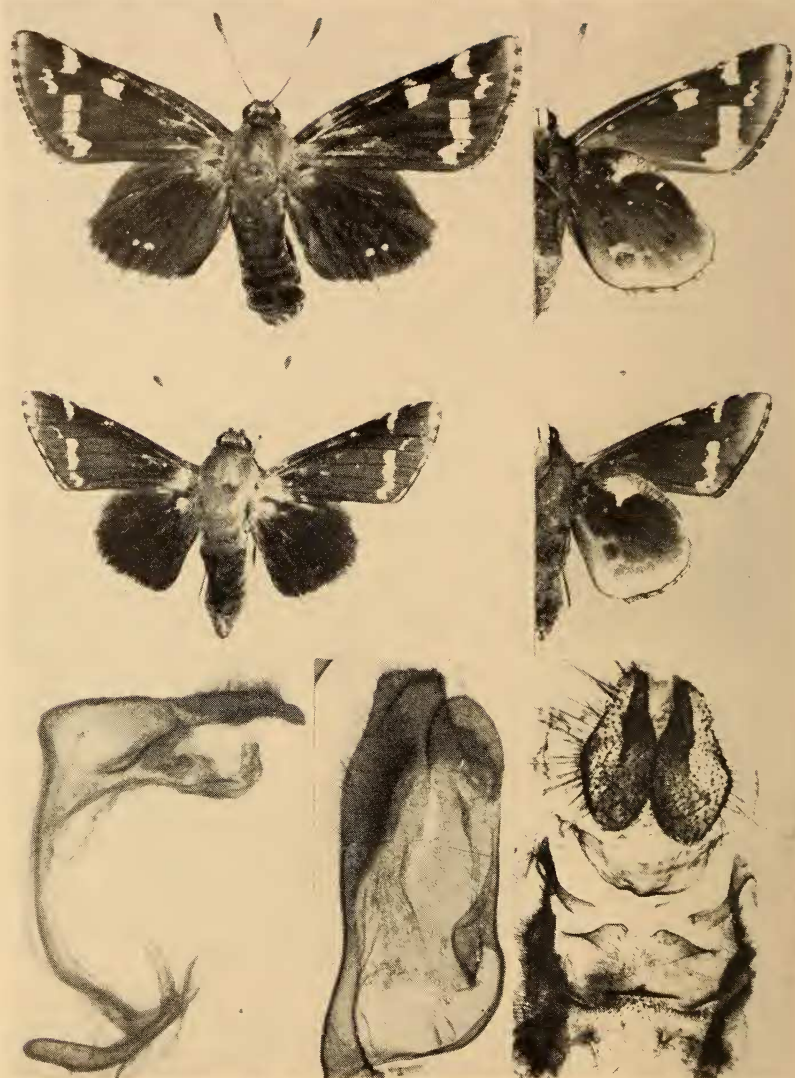
**MALE:** Like the female, except slightly smaller. In the male spots 5 and 6 are larger than those of the female.

Wing measurements of Allotype: forewing, apex to base 17 mm., apex to outer angle 12 mm., outer angle to base 13.5 mm.; hindwing, base to end of vein  $Cu_1$  13 mm. (The under surface of the male pictured is reversed in order to depict the less damaged underside.)

Described from 4 specimens (1 male and 3 females) reared from larvæ collected near Chilpancingo, Guerrero, Mexico, on highway 95 at Klm. 235 at an elevation of 2300 ft., emerging from Sept. 15 to 23, 1956. Collected by Dr. & Mrs. R. C. TURNER, Dr. J. R. TURNER, DEE, JACK, VIOLA and DON B. STALLINGS.

**HOLOTYPE.** female, Sept. 15, 1956, and **ALLOTYPE**, male Sept. 23, 1956, are in the collection of the authors.

The food plant is a medium-sized *Agave* plant, very succulent, that prefers to grow on the sheer sides of the rocky hills of the area. To reach the plants and secure the larvæ is no easy matter. (This plant may prove not to be a true *Agave*.) The juice of this plant, like many of the *Agave*, is highly irritating to the skin, like Poison Ivy.



Top row: *M. yuccae wilsonorum* HOLOTYPE ♀, Victoria, Mexico, 15 Febr. 1954 (S. & T. Collection).

2nd row: *M. yuccae wilsonorum* ALLOTYPE ♂, Victoria, Mexico, 17 Febr. 1954 (S. & T. Collection).

[Uppersides at left; undersides at right]

Lower row: *M. yuccae wilsonorum* genitalia, left to right: ♂ uncus and ♂ valva, Victoria, Mexico, 9 March 1953 (No. 206, S. & T. Collection); ♀ genital plate, Victoria, Mexico, 9 March 1953 (No. 57, S. & T. Collection).



Pupæ removed from the larval cavity died, probably because of their need for high humidity.

The life-history of this species presents a fourth group among the trap door builders. We assume that the female glues a single egg on the upper side of the leaf near the tip. We know that the larva enters the leaf here and bores downward in a most irregular manner, depositing its frass in its burrow behind it. When it reaches the base of the plant it may burrow back and forth across the base of the leaf or cross over into another leaf before it starts upward. In its final stages the larva burrows about one-fourth of the way upward in the leaf, where it makes an opening to the outside on the upperside of the leaf. The trap-door covering the opening is very thin and blackish (trap doors made in captivity were almost clear.) The burrow in the area where the larva pupates does not appear to have any white powder. The larvæ are white with a blue tint. The pupal cremaster has bristles and hooks.

This species appears closest to *Megathymus mejicanus* but is easily distinguished by its smaller size and the difference in the discal band of the secondaries on both surfaces. On the upper surface of the secondaries *M. hazelæ* does not have two spots above the discal band (just below the costal area) nor do the spots at each end of the discal band (upper surface) extend outward as they do in *M. mejicanus*.

This species is named in honor of BEULAH HAZEL STALLINGS, the step-mother of the first named author, who patiently made and mended his butterfly nets as a boy and fostered his interest in Lepidoptera.

### *Megathymus mejicanus* Bell

Thus far we have not been able to collect *Megathymus mejicanus*. Due to wet weather we were unable to get to type locality. Near the city of Durango in the state of Durango (not far from the type locality) we did secure a single larva that has a life history like *Megathymus hazelæ*. We were unable to get it to pupate. We suspect that it was *M. mejicanus*.

### *Megathymus yuccæ wilsonorum* Stallings & Turner, new subspecies

FEMALE. Upper surface of primaries: flat black, with a few yellowish hairs near the base. The outer margin from the apex to the middle of the wing is narrowly overscaled with white scales, changing to pale yellow downward. Spots 2, 3, and 4 (subapical spots) are white. All other spots are yellow, with spots 5 and 6 (submarginal spots) paler than the rest. Spots 7 and 8 are square. Spot 9 is triangular with the apex pointed inward and with the base deeply indented inward. Spots 5 and 6 are well outside of a line drawn along the outer edge of spots 2, 3, and 4 and 7 and 8. The fringes are faintly checkered gray and black.

Under surface of primaries: black, with the outer margin overscaled with white. All spots of the upperside reappear, with the yellow spots somewhat paler than the spots above.

Upper surface of secondaries: black with just a few yellowish hairs at the base. There is a pale yellow border 2 mm. wide. Spots 10 and 11 are usually missing. Spots 12 and 13 are tiny yellow dots (one specimen has no spots on the secondaries). The fringes are white.

Under surface of secondaries: black, with the outer portion of the costal area overscaled with white. There are two white spots immediately below the costal area, linear in shape, with the inward spot twice as large as the other. Below these two spots is a small white dot.

Abdomen black above, gray beneath. Thorax: black gray above, lighter beneath. Palpi are sordid white. Antennæ have the club black with some white beneath; the remaining portion is black, ringed with white above and nearly all white below.

Length of forewing varies from 33 to 35 mm., average 34 mm. Wing measurements of Holotype: forewing, apex to base 34 mm., apex to outer angle 21 mm., outer angle to base 23.5 mm.; hindwing, base to end of vein  $Cu_1$  24 mm.

MALE. Upper surface of primaries: black with a few yellowish hairs near the base. The outer margin from the apex to the middle of the wing is narrowly overscaled with white scales. Spot 1 (cell spot) is usually absent, with some specimens showing a dot of yellow. Spots 2, 3, and 4 are white and narrow. Spots 5 and 6 are mere lines of color, with the upper part of spot 5 usually missing. Spots 7, 8, and 9 are very small, otherwise similar to those of the female. The fringes are gray and black.

Under surface of primaries: black, with the outer margin overscaled with white. The spots reappear and are paler, except that spot 5 is missing and spot 6 is incomplete.

Upper surface of secondaries: black, with a few yellowish hairs at the base. There is a pale yellow border 2 mm. wide. The fringes are white.

Under surface of secondaries: similar to the female except that the male has more white overscaling and the outer white spot below the costal area and the white spot near the center of the wing are usually absent.

Abdomen, thorax, palpi and antennæ are the same as in female, except the antennæ have more white on the upper side.

Length of forewing varies from 28 to 30 mm. Wing measurements of Allotype; forewing, apex to base 28 mm., apex to outer angle 15.5 mm., outer angle to base 19 mm.; hindwing, base to end of vein  $Cu_1$  18.5 mm.

Described from 10 specimens (3 males and 7 females) reared from larvæ. Collected by Dr. & Mrs. R. C. TURNER, DEE, JACK, VIOLA and DON B. STALLINGS around Victoria, Tamps., Mexico, emerging from February 10 to March 10. It is named in honor of our good friends Mr. & Mrs. KENT H. WILSON.

HOLOTYPE, female, Feb. 15, 1954, and ALLOTYPE, male, Feb. 17, 1954, are in the collection of the authors.

The food plant appears to be closely related to or is a variety of *Yucca treculeana*. Considered with the type series, but not made a part thereof, were 11 specimens from Mission, Texas, and 6 specimens collected south of Reynosa, Mexico, near General Bravo, both of which fed on *Yucca treculeana*; 4 specimens from near China, Mexico and 4 specimens from near Victoria, Mexico, both of which fed on *Yucca (Samuela) carnerosana*.

This subspecies is easily distinguished from all other subspecies by the fact that spots 5 and 6 on the primaries of both sexes lie well outside of a line drawn down the outer edge of spots 2, 3, and 4 and 7 and 8. There are many other differences.

## THE SUBDIVISIONS AND RELATIONSHIPS OF THE MEGATHYIMIDÆ

After some 15 years of collecting and studying the Megathymidæ we have compiled enough data and information to draw some conclusions above the species level, even though there remain unknown or uncertain factors.

The first major break is the division of the family into the "tent" builders and the "trap-door" builders. This appears to be a sub-family division. Other natural divisions appeared as our studies continued.

In order to understand these divisions or differences we grouped the species into related complexes, as follows:

Maculosus complex: *maculosus* and *smithi*.

Yuccæ complex: *yuccæ* and its many subspecies.

Ursus complex: *ursus*, *violæ*, and *beulahæ*.

Cofaqui complex: *cofaqui*, *harrisi*, *streckeri*, and *texana*. (We consider *leussleri* a subspecies of *texana* and *albobincta* a dwarf form of *texana*.)

Mariæ complex: *mariæ*, *stephensi*, *comstocki*, *remingtoni*, and *estelleæ*.

Neumoegeni complex: *neumoegeni*, *mc Alpinei*, *florenceæ*, *judithæ*, and *carlsbadensis*.

Julia complex: *juliæ*, *chisosensis*, and *hoffmanni*.

Belli complex: *belli* and *evansi*.

Baueri complex: *baueri*, *aryxna*, and *indecisa*.

Rethon complex: *rethon*.

Polingi complex: *polingi*.

Alliæ complex: *alliæ*.

Hazelæ complex: *hazelæ* and *mejicanus*.

Hesperiaris complex: *hesperiaris*.

Some of the major assumptions that we have had to make on this arrangement are that: *streckeri* and *texana* build tents; *indecisa* belongs to the group assigned; *smithi* has more than one brood; Mariæ, Neumoegeni, Juliæ, Belli, Baueri, Rethon, Polingi, and Alliæ complexes do not glue their eggs to the plant, although we suspect that *polingi* and perhaps others do.

It is also evident that a few species assigned to a complex do not fit completely with the others in that complex: *beulahæ* with its extreme sexual dimorphism and *cofaqui* with its early flight period are good examples.

We then selected 20 major characters that seem to be above the intra-specific level by which to classify these complexes. The characters we have used are:

1. Food plant: A. *Yucca*; B. *Agave*; C. *Manfreda* and allied genera.
2. Cover over larval opening in plant: A. tent; B. trap-door.
3. Size of normal individuals: A. large; B. medium; C. small.
4. Shape of cremaster: A, B, C, D, or E as designated on Plate 7.
5. Larvæ deposit frass outside plant: A. yes; B. no.
6. Color of upper secondaries: A. single color or two colors with one in distinct spots or bands; B. two colors with one suffused.
7. White powder in pupal cavity: A. yes; B. no.
8. Sexual dimorphism: A. extreme; B. considerable; C. some; D. very little.
9. Eggs glued to plant: A. yes; B. no.
10. Difference in wing shape between sexes: A. considerable; B. little to none.
11. Light color on upper surfaces: A. whitish to yellow-brown; B. orange to orange-red.
12. Larvæ dormant approximately 60 days (or more) before pupating: A. yes; B. no.
13. Manner of larval feeding: A. suck; B. chew; C. probably both.
14. Number of broods: A. one; B. more than one.
15. Flight period: A. spring; B. early summer; C. late summer; D. fall.
16. Distinct depression between true uncus and tegumen of male genitalia: A. yes; B. no.
17. Proharpe of male genitalia: A. longer than cucullus of valva; B. approximately same length as cucullus; C. shorter than cucullus; D. appears absent.
18. Cucullus of valva of male: A. narrow and long; B. broad and long; C. short and blunt.

19. Female vaginal plate: A. simple and thin; B. complex and thick.  
 20. Bristles on female vaginal plate: A. black; B. dark; C. light; D. none.

It is evident that the 20 characters that we used do not all have the same value. We have given each character a subjective value that we consider appropriate, the top value being 4 and the lowest value being 1. This gave us a total of 60 points with which to compare the complexes. Diagram 1 shows the application of these characters to the species complexes; the number in parentheses, following the character number, is the value assigned to that character.

	Megathymid complex	Yuccæ complex	Ursus complex	Cotacul complex	Polingl complex	Alliæ complex	Marlæ complex	Hemipent complex	Belli complex	Bethon complex	Juliaæ complex	Baueri complex	Hesperiaris complex	Rasaelæ complex
1. (4)	C	A	A	A	B	B	B	B	B	B	B	B	B	B
2. (4)	A	A	A	A	B	B	B	B	B	B	B	B	B	B
3. (4)	B	B	A	A	C	A	C	B	A	C	B	B	A	C
4. (4)	B	A	A	A	E	E	E	E	E	E	E	E	D	C
5. (2)	A	A	A	B	A	A	A	A	A	A	A	A	A	B
6. (3)	A	A	A	A	A	A	A	B	A	A	A	A	B	A
7. (3)	A	A	A	A	A	A	A	A	A	A	A	A	B	B
8. (2)	C	A	C	A	B	B	C	C	C	D	B	B	D	D
9. (4)	A	A	A	A	B	B	B	B	B	B	B	B	A	A
10. (1)	A	A	A	A	A	A	A	A	B	B	A	A	B	B
11. (1)	A	A	A	A	A	A	A	B	A	A	B	A	B	A
12. (3)	B	A	B	B	A	A	B	A	A	B	A	A	A	B
13. (4)	B	B	B	B	A	A	A	A	A	A	A	A	C	C
14. (4)	B	A	A	A	A	A	A	A	A	A	A	A	A	A
15. (4)	A D	A	C	B	D	D	D	D	D	D	D	D	D	D
16. (3)	B	B	B	B	A	A	A	A	A	A	A	A	A	A
17. (2)	D	B	C	C	A	A	A	A	A	A	A	A	C	D
18. (2)	C	C	C	B	A	A	A	A	A	A	A	A	A	C
19. (4)	A	A	A	A	B	B	B	B	B	B	B	B	B	B
20. (2)	D	B	B	B	C	B	B	C	B	A	B	B	A	A

DIAGRAM 1

Diagram 2 gives us the degree of likeness between the complexes. For example the Yuccæ complex has 45 points out of a maximum of 60, of similarity with the Ursus complex, but only 13 with the Hesperiaris complex, showing that the Yuccæ complex is much more closely related to the Ursus complex than to the Hesperiaris complex.



DIAGRAM 2

Maculosus complex	Maculosus complex	Yuccae complex	Ursus complex	Cofaqui complex	Polingi complex	Alliae complex	Mariae complex	Neumoegeni complex	Belli complex	Rethon complex	Juliae complex	Baueri complex	Hesperiaris complex	Hazelae complex
Maculosus complex														
Yuccae complex	39													
Ursus complex	36	45												
Cofaqui complex	30	43	50											
Polingi complex	12	17	14	12										
Alliae complex	12	19	20	18	54									
Mariae complex	17	19	21	17	53	51								
Neumoegeni complex	14	17	12	8	50	48	47							
Belli complex	13	18	21	17	51	57	52	49						
Rethon complex	14	15	16	18	52	48	55	44	49					
Juliae complex	15	23	15	13	53	55	50	53	52	47				
Baueri complex	16	23	16	14	54	56	51	52	53	48	59			
Hesperiaris complex	8	13	16	14	30	34	27	34	35	32	31	30		
Hazelae complex	17	14	17	17	31	27	34	23	28	39	26	27	39	

Diagram 3 gives the family tree as it now appears, based on this analysis. It is our opinion that the Cofaqui—Yuccæ—Ursus branch are the genus *Megathymus*; that the Hesperiaris branch is the genus *Ægiale*; that a) the Maculosus branch, b) the Hazelæ branch, and c) the Neumoegeni—Alliæ—Juliaë—Baueri—Polingi—Mariæ—Rethon—Belli branch represent three unnamed genera.

The relative positions of the species groups in Diagram 3 do not always represent our own personal beliefs. According to the diagram the Cofaqui and Hesperiaris groups represent the more primitive groups, with the Maculosus group representing one of the more advanced groups. Frankly, we have always felt that the Maculosus group was the present representative of the ancestral type from which the family Megathymidæ evolved, for these reasons: 1) it is double brooded, suggesting that a spring brood developed into tent-builders while a fall brood developed into trap-door builders; 2) the genitalia are simple, suggesting primitiveness to us. We are advised by others, who are more qualified on the subject, that point 2, particularly, is often to be considered evidence of advancement rather than primitiveness, hence the diagrammed arrangement.

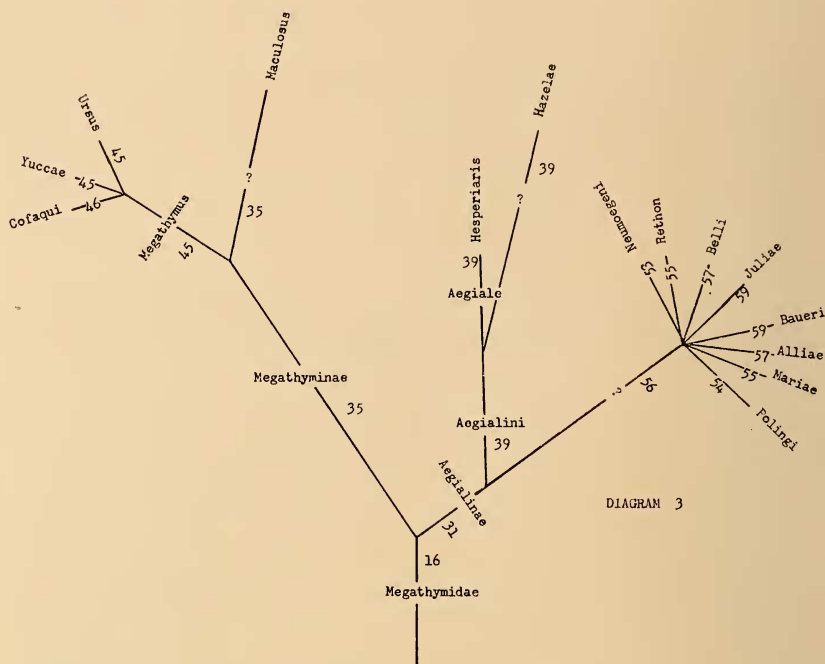


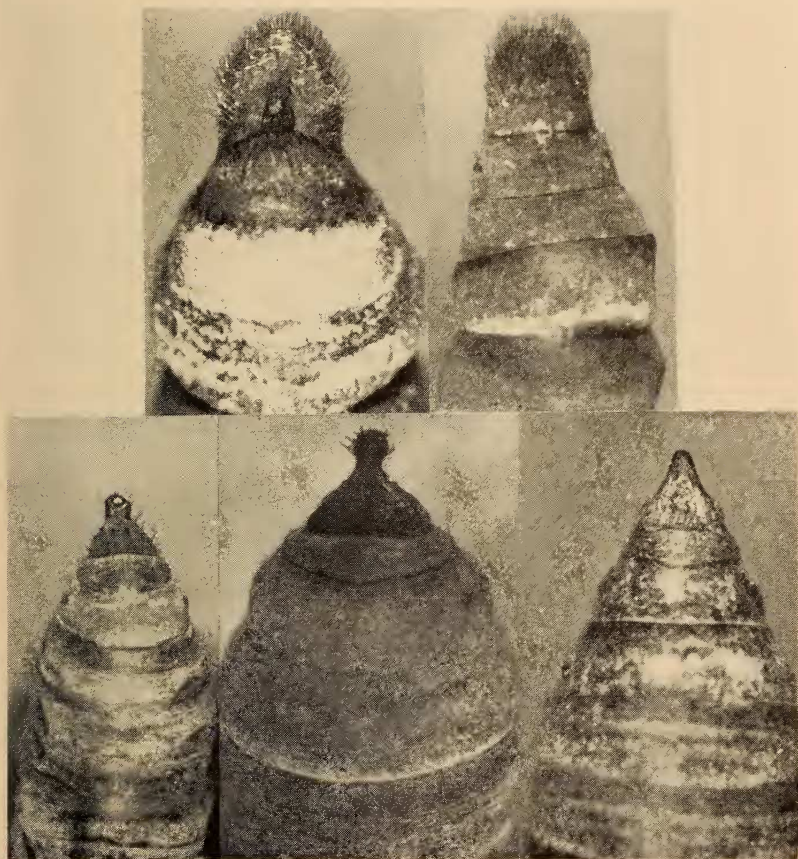
DIAGRAM 3

The cremasters pictured on Plate 7 represent the five basic shapes of cremasters of the Megathymidæ and show a basic generic character. The cremasters on Plate 8 are pictured to show the characters below the genus level. These five cremasters, along with the last specimen on Plate 7 are all of one genus characterized by a triangular shape. Each of these six represents the basic shape of the cremaster in the group designated. Below this level each species appears to have its own shape of cremaster. Examination of over 1000 specimens indicates that the characters of the cremaster at the species level are as good as or better than the genitalia. All cremasters pictured have been enlarged the same amount so that relative sizes can be determined.

The conclusions regarding the genera, reached in this paper, are not new. For a number of years, H. A. FREEMAN, along with us, has recognized these five genera. It is that we are just now amassing enough evidence to prove these beliefs. In a forthcoming paper FREEMAN will describe these three unnamed genera. While his paper is separate from ours, the conclusions expressed in both papers represent our joint opinions.

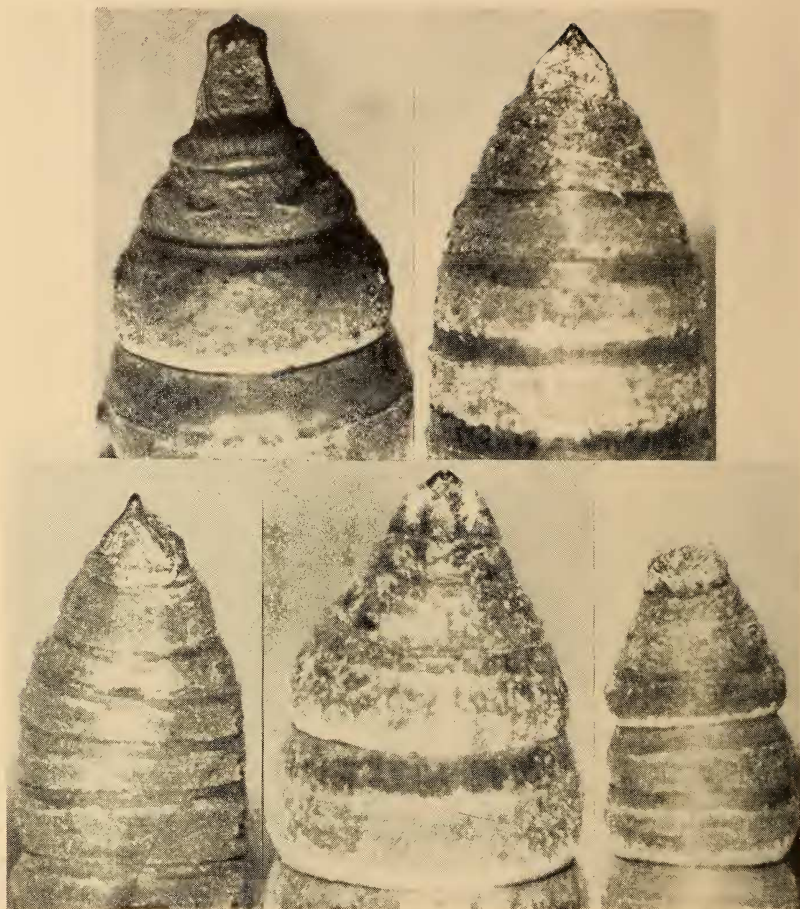
We anticipate that C. L. REMINGTON will follow these papers with a paper on the larvæ of the Megathymidæ.

CARLOS C. HOFFMAN (*Anales Inst. Biol. Mex.* 12:237-294, 1941) listed the following species (among others) as occurring in Mexico: *Megathymus yuccæ*, *M. yuccæ navajo*, *M. streckeri*, *M. streckeri texana*, *M. neumoegei*,



Top row, left to right: A. Cremaster spatulate with bristles (*M. yuccæ*, Pensacola, Fla.); B. Cremaster squarish with bristles (*M. smithi*, Guadalajara, Mexico).

Bottom row, left to right: C. Cremaster triangular with squarish knobbed tip and with a few hooks and bristles (*M. hazelæ*, Chilpancingo, Mexico); D. Cremaster triangular with round knobbed tip and with many hooks and bristles (*A. hesperiaris*, Ojocaliente, Mexico); E. Cremaster triangular with minute bristles or none (*M. judithæ*, Hueco, Texas).



Top row, left to right: F. Belli group (*M. belli*, Chihuahua, Mexico); G. Rethon group (*M. rethon*, Cuautla, Mexico).

Bottom row, left to right: H. Mariæ group (*M. mariæ*, Carlsbad Caverns, N. Mex.); I. Allia group (*M. allia*, Cameron, Ariz.); J. Polingi group (*M. polingi*, Tucson, Ariz.).



*M. neuvoegeti stephensi*. We do not expect to find any of these species in Mexico. We do expect to find the following: *Megathymus yuccæ arizonica* and perhaps *martini*.

We wish to give our thanks to Dr. C. L. REMINGTON for his assistance in preparing this paper. Our thanks also go to Dr. C. D. MICHENER, WILLIAM D. FIELD, Dr. F. H. RINDGE, KENT WILSON, Dr. T. ESCALANTE, the Plant Quarantine Branch of the Agricultural Research Service of the United States and the Secretario de Agricultura y Ganaderia of Mexico for their assistance and cooperation.

Caldwell, Kansas, U. S. A.

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## MEGATHYMUS YUCCÆ IN NORTH CAROLINA

by ROBERT B. BUTLER and CHARLES V. COVELL, JR.

After a long period of apparent neglect, much attention has been given to the Giant Skippers of the genus *Megathymus* lately, as witnessed by recent articles in the *News* on important observations concerning that genus. It was on one of our regular collecting trips in the Southern Pines, N. C., area that we first became interested in *Megathymus yuccæ* Boisduval & Leconte. On 21 April 1951, BUTLER noticed an unfamiliar butterfly dart out of a laurel bush and alight on a fallen pine cone in a hilly area characterized by sandy soil, long leaf pines, scrub oak, and an occasional *Yucca filamentosa* Linnæus. Upon capturing the specimen, he found it to be a battered female *M. yuccæ*. There were no subsequent captures and interest in the species faded for the next three years. BUTLER gave his lone specimen to the North Carolina Division of Entomology in Raleigh.

In 1955 while attending the University of North Carolina, COVELL met JOHN P. KNUDSEN, a collector who had taken *M. yuccæ* in Georgia. It was from him that COVELL learned more about this interesting genus and how to find and dig out the larvæ and pupæ. With this information we began searching for the gray-brown tent-like structures constructed by the larvæ at the center of the rosette of each inhabited yucca plant. On 9 April 1955 COVELL found a *M. yuccæ* pupa but the adult failed to emerge. In June of that year we found several *Y. filamentosa* whose central leaves had been eaten, and in which were ensconced some pink caterpillars. In August, BUTLER dug up six of these plants, keeping them in pots and bushel baskets until the following Spring. Two *Megathymus* emerged.